

FAA Wide Area Augmentation System



A major goal of the International Civil Aviation Organization (ICAO) is near-universal use of a Global Navigation Satellite System (GNSS). ICAO supports augmenting GNSS to provide for increased civil aviation safety and capacity. The FAA's Wide Area Augmentation System (WAAS) has become a critical component of seamless satellite navigation system for civil aviation. This system improves the accuracy, availability, and integrity of GPS, thereby improving the safety and capacity provided by the U.S. National Airspace System (NAS). Ultimately, WAAS will allow GPS to be used as a primary means of navigation from takeoff through Category I precision approach.

The WAAS signal-in-space (SIS) will cover the entire Continental U.S. and Alaska. This single system provides service to most of the NAS through all phases of flight, thus providing much of the same capability that currently needs hundreds of ground-based nav aids (GBNA). The WAAS provides augmentation information to GPS/WAAS receivers to enhance the accuracy and reliability of GPS position estimates. The signals from GPS satellites are received across the NAS at many widely-spaced wide area reference stations. Each reference station relays the information, via a terrestrial communication network, to WAAS wide area master stations. The master stations use the information collected by the reference stations to develop corrections to the GPS position information. These corrections are sent to a ground uplink station where they are transmitted in the form of a WAAS correction message to a Geostationary Earth Orbit (GEO) satellite. These GEOs broadcast the WAAS message to users across the U.S., and portions of Alaska, on the same frequency as GPS. The WAAS broadcast message improves GPS signal accuracy from 20 meters to approximately 1.5 - 2 meters in both the horizontal and vertical dimensions, allowing more efficient arrival, enroute, and departure operations at low cost to an increased number of airports throughout the U.S. WAAS also provides savings from simplified cockpit avionics for all classes of aircraft.

Additionally, WAAS provides indications to GPS/WAAS receivers of where the GPS system is unusable due to system errors or other effects. Further, the WAAS system was designed to the strictest of safety standards – users are notified within six seconds of any issuance of hazardous misleading information that would cause an error in the GPS position estimate.

The FAA commissioned WAAS at 12:01 AM on July 10, 2003. This step moves the FAA directly to Lateral Navigation/Vertical Navigation (LNAV/VNAV) and LPV capabilities using WAAS. Both LNAV/VNAV and LPV approaches use the accuracy of the WAAS signal to include vertical (glide path) guidance capability. This capability facilitates improved instrument approaches to include vertical (glide path) guidance to an expanded number of airports throughout the U.S.

There are nearly 600 LNAV/VNAV approaches available today at nearly 300 airports throughout the NAS. The FAA is continuing to develop these procedures, adding many more each year.

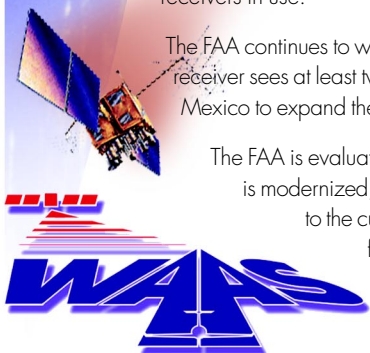
The implementation of LPV approaches further improves precision approach capability to users. LPV approaches are designed to fully exploit the tighter satellite signal protection limits from the WAAS. This approach combines the LNAV/VNAV vertical accuracy with lateral guidance similar to the typical Instrument Landing System. The use of LPV approaches capitalizes on the inherent accuracy of the WAAS signal and will result in lower approach minimums. There are currently seven LPV approach locations in the U.S., and production will continue until all qualified airports have an LPV approach at each runway end.

WAAS is also a critical component of Required Navigation Performance (RNP). WAAS can provide the most stringent RNP for Random Navigation/Area Navigation (RNAV) to all classes of users throughout the NAS. As air traffic management becomes more global, the WAAS concept can be applied to civil aviation infrastructure worldwide, enabling global safety improvements. Also, with more stringent RNP standards, inefficiencies in airspace utilization could be reduced, thus increasing traffic flows and avoiding delays.

Although the WAAS was designed for aviation users, it supports a wide variety of non-aviation uses including agriculture, surveying, recreation, and surface transportation, just to name a few. The WAAS signal has been available for non safety-of-life applications since August 24, 2000, and numerous manufacturers have developed WAAS-enabled GPS receivers for the consumer market. Today, there are millions of non-aviation WAAS-enabled GPS receivers in use.

The FAA continues to work toward Final Operational Capability (FOC) for WAAS to include a full complement of WAAS GEOs, which will ensure that each receiver sees at least two GEO satellites at all times throughout all of the Continental U.S., and most of Alaska. The FAA is also working with Canada and Mexico to expand the WAAS coverage area to support North American implementation of WAAS.

The FAA is evaluating the approach to achieve a Global Navigation Satellite System (GNSS) Landing System (GLS) capability in later years. As GPS is modernized, WAAS will continue to evolve to take full advantage of GPS modernization, including the L5 frequency. In fact, the FAA is adding L5 to the current WAAS GEOs. The FAA is also involved in ICAO's GNSS panel, which supports the development of standards and procedures for satellite navigation for civil aviation applications worldwide.



For further information on WAAS, please visit our website at:

<http://gps.faa.gov>